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The intestinal tube absorption process with regard to shaped components (sumi* powder, tubercle bacilli, blood corpuscle powder, carmine)

By

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(16th Japanese Medicine Meeting, Department of Pathology, Summarized Lectures)

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According to traditional general physiological principles the absorption of substances by the muscles, stomach and intestinal tube is reputed to take place in liquids and dissolved substances. This however is not necessarily always the case. Shaped bodies are also absorbed. When for instance administering tubercle bacilli to animals, one discovers tubercle bacilli in the portal veins blood of these

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*Translator's note: Japanese ink stick; wetted when needed for brush calligraphy; same hereafter.

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animals, or tuberculosis is produced in the mesenteric lymph gland, the liver, the lungs and such. This means that shaped tubercle bacilli have been absorbed by the digestive tube. There are extremely few histological studies explaining through what part of the intestines and by what process these tubercle bacilli achieve their penetration or by which route they enter the body. As there are no satisfactory explanations, we undertook the present study in the hope of clarifying this matter from a histological viewpoint. On this sole premise, we examined the process whereby sumi powder, 「carmine」 blood corpuscle powder and such are absorbed inside the digestive tube.

To begin with sumi powder, the fact is that some people have already examined its absorption inside the intestinal tube. During last year's Japanese Pathology convention, Mr. Takeuchi from Kyushu reported on tests conducted on toads and rabbits. His results on rabbits match virtually my own. That is, to say, the site where the sumi powder is absorbed is determined in the intestinal tube. It is necessarily absorbed by and only the lymphatic follicle and not by the other chorionic mucous membranes. The absorption image shows that (the powder) turns into fine granules inside the protoplasm of the cylindric epithelial cells covering the follicle, that the sumi powder is p. 430 secondarily absorbed also by the reticular system cells in the lymph cavity under the mucous membrane and reaches gradually the deeper part follicles. So, in order for the sumi powder to be absorbed by the intestinal tube it must not necessarily go through the above route only. It is also absorbed in another way. The particular places of absorption are the same but there are almost no sumi powder granules in the epithelial cells of the upper lymph follicle of this part but they

go through the space between the epithelial cells or penetrate also the follicle. That is, they penetrate by permeating the Schlussleisten present between the epithelial cells. This image appears first only in the Peyer patches* when a very large volume of sumi powder has been administered.

We examined in the second place how "carmine" is absorbed by the inner digestive tract. That is, we administered soda "carmine" to rabbits, sacrificed later the animals and examined the stomach and intestines. By doing so, we determined by the same method as before the parts where the absorption took place. Absorption was most conspicuous in the vermiform process and in the lymphatic follicle patches of the cecum, and then in the Peyer patches of the small intestine. The absorption image is as follows. There is first transformation to fine "carmine" granules and absorption inside the protoplasm of the top epithelial cells covering the follicles, followed by absorption through the reticular system cells and histocyte cells beneath the epithelial cells.

In the third place, we dried and crushed blood corpuscles at low temperature, administered this fine powder to well developed rabbits and attempted detailed iron reactions with regard to the tissues of the various sites in the stomach and intestines. The results show that the blood corpuscle components are absorbed by the chorionic mucous membrane of the duodenum and upper small intestine. Thereafter, one sees granules exhibiting the Berlin blue reaction in

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*Translator's note: the text uses a character meaning "working group", "squad"; this could be a mistake for another very similar character (with the same pronunciation) meaning "spot", "stain"; same hereafter for the word "patch".

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the cells covering the inside of the chyle-vessel. We were also perfectly able to prove that the iron components are absorbed by the mucous membrane of the cecum, by the lymph follicles of this part as well as by the vermiform process. This means that without considering the question of what chemical components the administered blood corpuscle powder becomes to be absorbed by the intestinal-tube, it is anyway certain that the iron components are absorbed. The present study shows that in the clinical field, blood corpuscle powder is administered fairly efficiently in cases of anemia and such.

In the fourth place and finally, we administered to rabbits large quantities of live and dead tubercle bacilli and examined through what parts of the intestines, through what procedure the tubercle bacilli perform penetration, by what route they enter the body. This means that we gave daily live or dead tubercle bacilli to well developed rabbits which were sacrificed later after 7 days, 10 days and two weeks. We performed a detailed histological examination of the various parts of the stomach and intestines. The results show that the p. 431
parts penetrated by the tubercle bacilli whether alive or dead are the lymph follicle patches of the cecum part followed by the follicle of the vermiform process. We saw very few bacilli penetrating from the Peyer patches at the lowest part of the small intestine. This means that the penetration sites coincide with the human ileocecal parts. As for the tubercle bacilli penetration conditions, we saw that the bacilli separated inside the intestinal tube are absorbed inside the protoplasm of the upper cylindric epithelial cells covering the follicle part. In this case, the position of the bacilli is mostly oblique. Rarely, their position is horizontal. The bacilli absorbed

in this fasion by the epithelial cells are thereafter seen to be absorbed by the follicles present under the mucous membrane, by the gaps between the lymphs and reticular system cells as well as by the cells covering the inside of the lymph, by the histocyte cells and the like. Following this, the bacilli are absorbed down to the deep follicles and one sees many bacilli exhibiting a shape similar to that of the lepra globi. The bacilli having thus entered the lymph follicles of the intestines are thereafter carried to the mesenteric lymph glands and one sees here tubercle bacilli although not too many. We have not been able on the basis on the tissue image to show whether and how the bacilli are directly carried from the blood vessels to the liver.

In this test two things have caused an increase of interest. The first one is that although numerous bacilli had been absorbed inside the lymph follicles of the intestines 7 days, 10 days and 14 days after the administration of live and dead tubercle bacilli, none of the sites produced tuberculous changes but that penetration into the tissues was pursued.

The second is that since the time of the studies by Behring, Jisse* and such about contamination inside the intestinal tube and more particularly about contamination by the tubercle bacillus, it was believed that newborns or suckling infants tended to be infected intestinally by the tuberculosis bacillus but seldom the adults. Our recent research shows the exact opposite to be the case. We saw that to the contrary the absorption of shaped bodies occurs easily in well

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*Translator's note: Transliterated Japanese phonetic rendering of uncertain foreign name; "Schiess" ...?

developed animals. With regard to the tubercle bacilli, we believe that the two above facts that penetration was quite easy in well developed animals and that moreover no morbid changes were produced at the penetration site allow to corroborate precisely the general idea of Dr. Sata's long-standing claim that in the case of primary infection no change occurs at the site of the tubercle bacillus penetration, that absorption is easy and that on an immunological basis infection causes morbid changes at its site. We wish to make more tests so as to explain these facts better and better.

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